



NASA Information Technologies for Space Missions: Present and Future

IEEE Space Mission Challenges for Information Technology
Welcome and Plenary Address

Dr. Eugene Tu
Director, NASA Ames Research Center



EXPLORE EARTH

YOUR HOME, OUR MISSION



EXPLORE FLIGHT

WE'RE WITH YOU WHEN YOU FLY



EXPLORE HUMANS in SPACE



FOR ALL HUMANITY

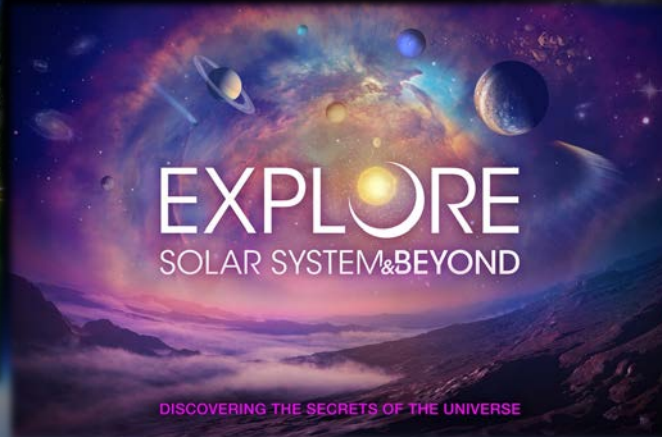
EXPLORE MOON to MARS

MOON LIGHTS THE WAY



EXPLORE SOLAR SYSTEM & BEYOND

DISCOVERING THE SECRETS OF THE UNIVERSE



EXPLORE SPACE TECH

TECHNOLOGY DRIVES EXPLORATION



Ames Research Center



- Occupants:
 - ~1200 civil servants; ~1,900 on-site contractors; ~2,500 NRP workforce
 - ~707 summer students in 2019
- FY20 Budget (est.): ~\$1,011M (including reimbursable/EUL)
- ~1,900 acres (400 acres security perimeter); 5M building ft²
- Airfield: ~9,000 and 8,000 ft. runways

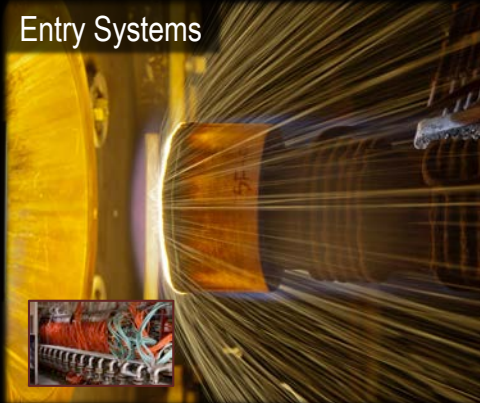
Core Competencies at Ames Today



Air Traffic Management



Entry Systems



Advanced Computing & IT Systems



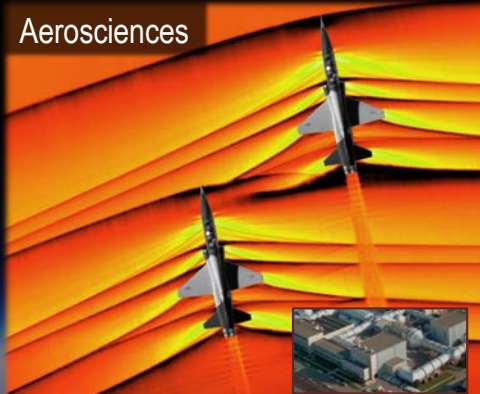
Intelligent/ Adaptive Systems



Cost-Effective Space Missions



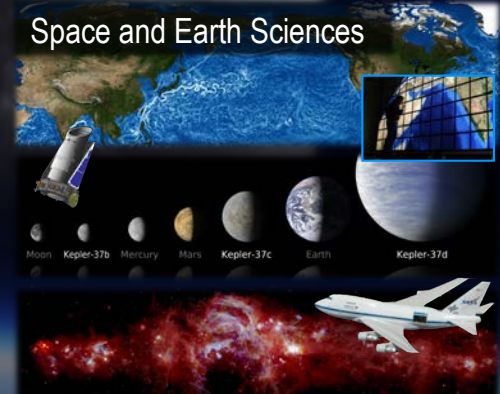
Aerosciences



Astrobiology and Life Science



Space and Earth Sciences



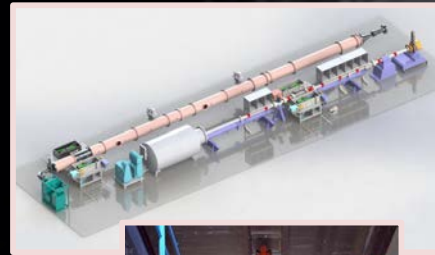
Major Research Facilities



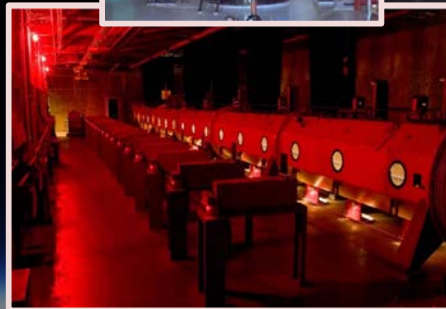
Wind Tunnels



ARC Jet Complex



Range Complex

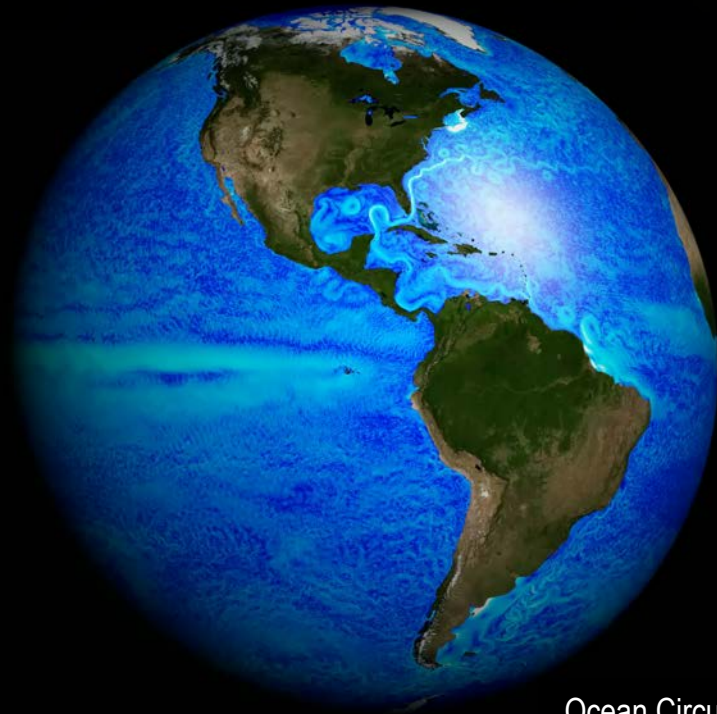


Simulators

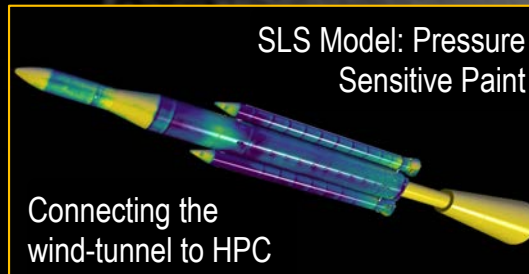


Advanced
Supercomputing

Modeling and Simulation

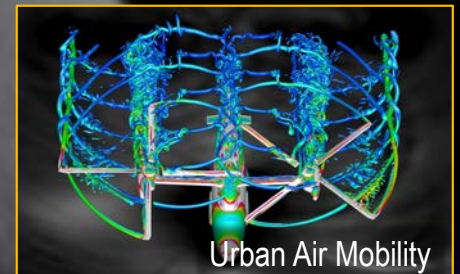


Ocean Circulation



SLS Model: Pressure Sensitive Paint

Connecting the wind-tunnel to HPC



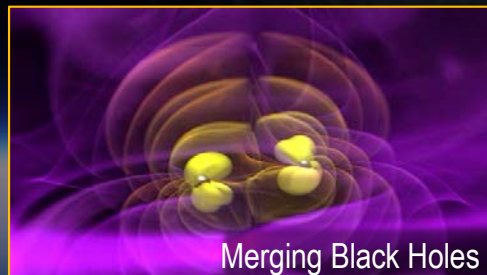
Urban Air Mobility



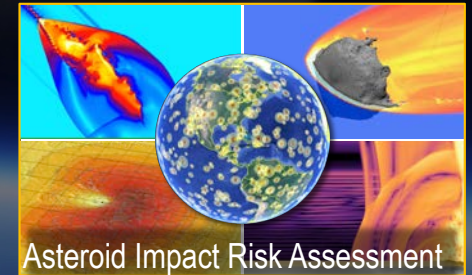
Corona Prediction of the 2017 Solar Eclipse



Orion Launch Abort System



Merging Black Holes

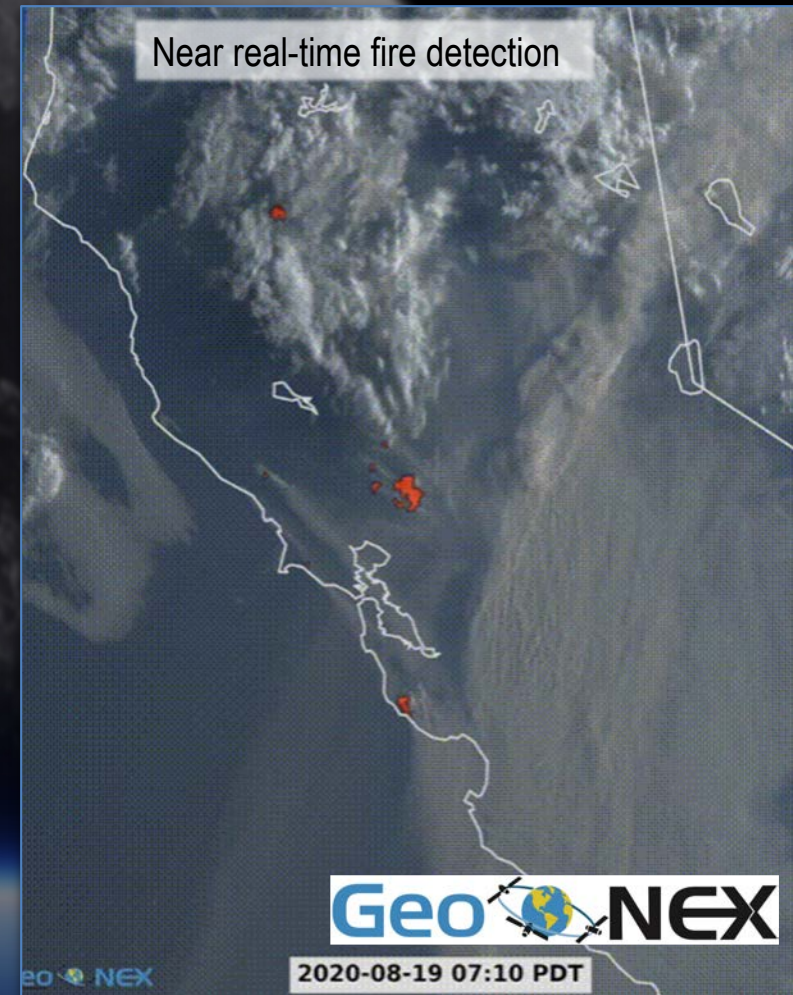
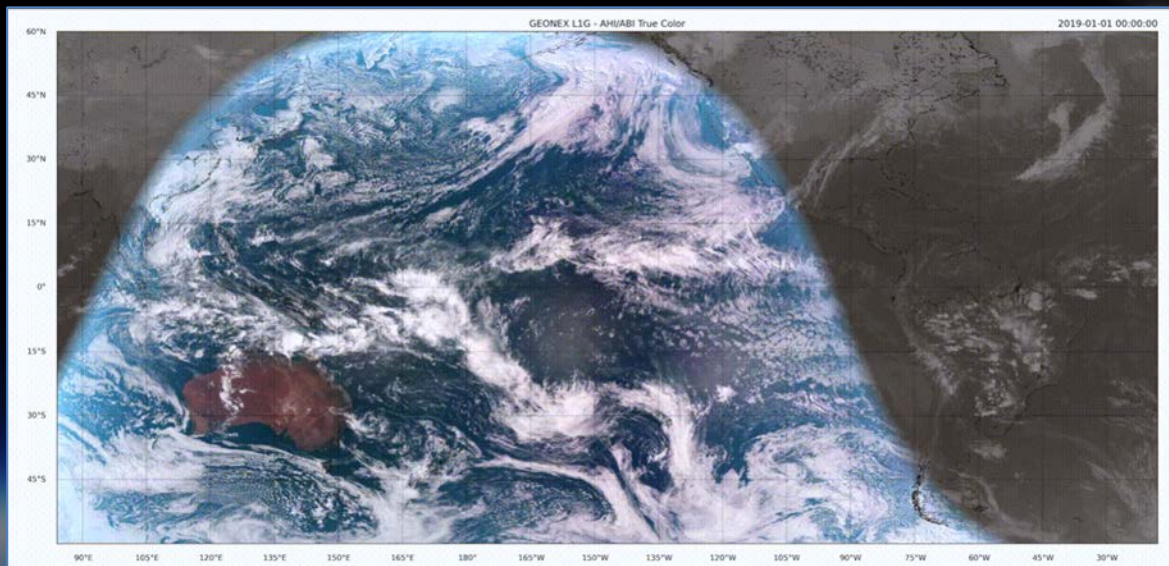


Asteroid Impact Risk Assessment

Global Earth Observing with Geostationary Satellites



The **NASA Earth Exchange (NEX)** harmonizes new geostationary satellite data to achieve near-global coverage every 5-15 minutes





WILDFIRE: DETECT · VERIFY · INFORM · PREDICT



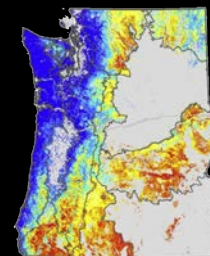
Vision:

Lead an interconnected program of innovation, scientific discovery, and partnerships to continuously improve wildfire response across the Nation

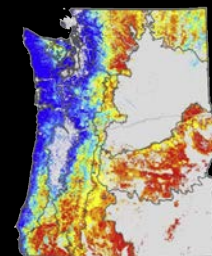
Mission:

Provide timely information regarding wildfires, innovate on monitoring approaches, conduct research on wildfire characteristics and establish partnerships with academia, industry, NASA Centers, other federal, state and local governments to implement a wildfire response and mitigation program.

2031 – 2060 Normal

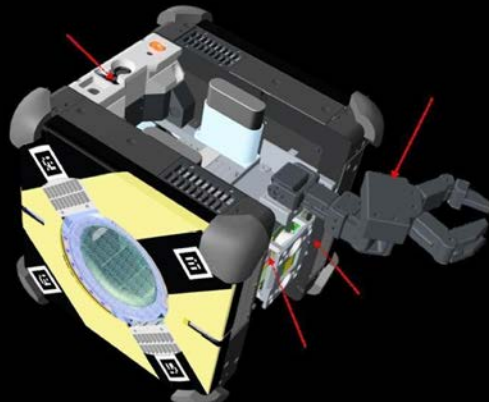
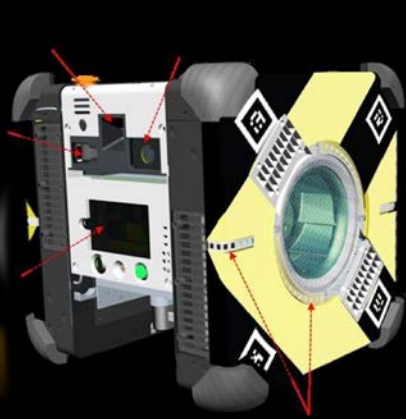


2071 – 2100 Normal



Future fire maps in the Pacific Northwest derived from NASA Earth Exchange Data (Davis, et al, Forest Ecology and Management, 2017)

Robotic Assistant on ISS



Astrobee (2019)



Ames for Artemis Phase 1: Lunar Surface by 2024

List of some Enabling Capabilities

- Orion Launch Abort **Simulations**
- SLS & Orion **Wind Tunnel** Tests and aero-database generation
- Cross Program Data Systems

Ultra Hi-Fi Lunar **Lander Surface Simulator**

Lunar science enabled by **SSERVI**

Entry Tech & **Arcjet** Test

LRO: Continued and landing site investigation

Gateway **CubeSat** Grand Challenges

Autonomy for Artemis Program (Gateway & HLS) - SW V&V, Caution & Warning, AI Ops

Human-System Integration for Artemis Program

Artemis II
Humans to orbit the Moon in the 21st century

Solar Electric Propulsion System

Pressurized Module
First pressurized module delivered to Gateway

Human Landing System

Artemis III
Crewed mission to Gateway and lunar surface

HLS Engineering Risk Assessment

Large-Scale Cargo Lander
and technology payloads

2024 **VMS** Training & Fit Control Dev for Lunar Lander

Commercial Lunar Payload Services

Early South Pole Mission(s)
- First robotic landing on eventual human landing site return and In-Situ Resource Utilization (ISRU) site

Lunar Terrain Vehicle

Volatiles Investigating Polar Exploration Rover
with unpressurized rover for lunar volatiles survey

Humans on the Moon
First crew leverages infrastructure left behind by previous missions

LUNAR SOUTH POLE TARGET SITE

2020

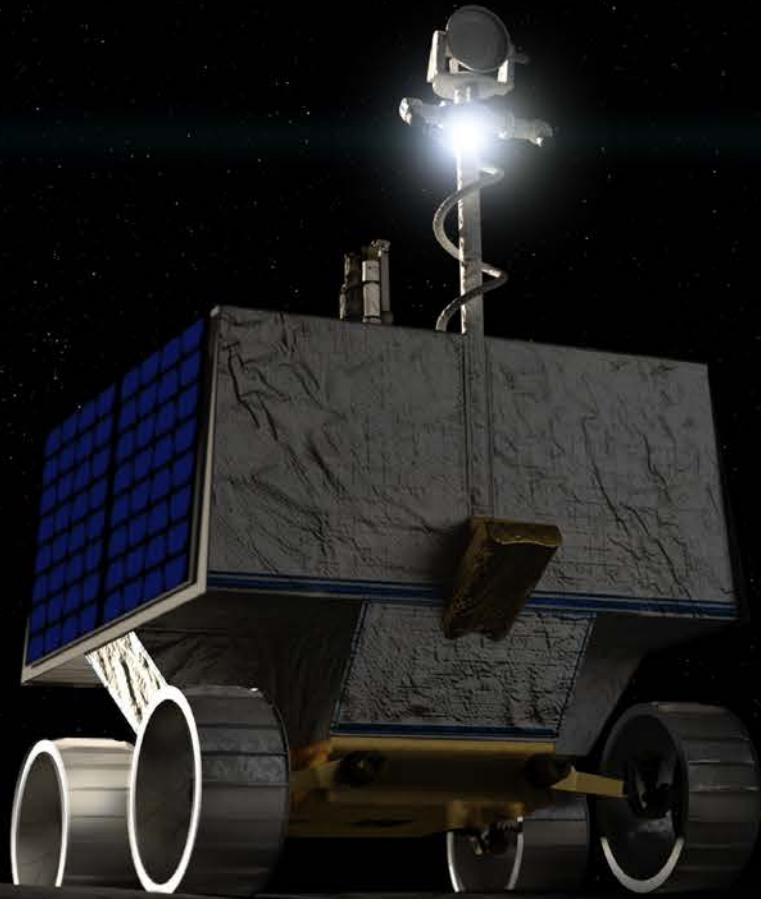
2019-24 CLPS Instruments (SMD)

2022 VIPER Prospecting Rover Mission (SMD)

2024

2019-24 LunarCOTS concepts

VIPER: Volatiles Investigating Polar Exploration Rover

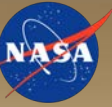


- Mobile robot that will go to the South Pole of the Moon
- Prospect for water ice and other resources to sustain human exploration on the Moon, Mars – and beyond
- First resource mapping mission on another celestial body
- Launch to the Moon in 2023



Rover, lander, and ramp models going through tests

Dragonfly Mission — New Frontiers 4



Dragonfly, a nuclear-powered octocopter to Titan, was selected as the 4th New Frontiers Mission in June 2019 and launches in 2026.

Traditional atmospheric entry & descent, enters Titan in 2034

Powered flight to landing site

Transition to a new landing site

Explore prebiotic chemistry and habitability

Quesrions

